



ICT-Based Strategies for Teaching and Learning (T-L) in Lesson and Unit Plans Designed by Colombian Teachers in a Program of Educational Innovation

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Abstract

This research analyzed a sample of 547 Unit Plans (UP) designed for teachers of basic school and high. Those UP were designed as part of a teacher training program developed in Bogotá, Colombia, called CreaTIC. The objective of this study was to evaluate the ratio between using ICT based strategies for teaching and learning (T-L) related to the development of Higher-Order Thinking Skills (HOTS), planning the active participation of students and playing a mediating role in teaching.

The analyzes indicate a ratio between planning T-L strategies as inquiry and structuring information by using digital educational resources, related to HOTS, and mediation activities proposed by the teacher (like feedback on creative process or knowledge application exercises). Similarly, planning inquiry as T-L strategy seems to be related to allocate the students activities like contextualization of their learning, knowledge application exercises and creative processes.

Furthermore, when considering the differences between rural and urban educational institutions, there is a strong correlation between planning activities applying knowledge and assign tasks to the students, involving structuring information and creative processes.

1. Introduction

During 2015 and 2016 the Ministry of National Education of Colombia and the Center for Regional Education Innovations (central zone) of the National University of Colombia and the Cundinamarca Government (Colombia), performed a training process for teachers, under a blended learning modality. This program called “CreaTIC” intended: to strengthen the ICT competences of the teachers aimed at making innovative changes in educational contexts, and to use ICT for the design, development and implementation of proper and innovative experiences.

In 2015, the Unit Plans (UP) made by the CreaTIC teachers was systemized, evaluating four main sections: curriculum, methodology, evaluation and use of digital educational resources. The last section indicated most of the teachers planned using resources in their UP to support teaching and practicing of skills by using and repeating concepts. These results lead to carrying out this study, with the purpose of identifying the ratio between the roles played by teachers and students and the methodologies based on the use of digital educational resources. It is expected the results to help understanding how the digital educational resources influence the innovation within teachers’ practice.

2. Framework

This research belongs to the study of transformations produced in teaching – learning processes when the technological resources are used by the teachers or students [1] [2] [3]. Several results suggest that “despite the availability of technological resources has increased in schools... teachers’ pedagogical practice in class does not always modify significantly the traditional teaching method” [4]. What’s more, the Colombian approach for the development of competences involves processes of teaching and learning that foster HOTS [5]. In this sense, one of the expectancies for fostering the integration of digital educational resources is, indeed, that the teacher plan learning and teaching strategies that stimulate this kind of processes.

Regarding this, and following the parameters of Bloom’s, Marzano’s and Kendall’s Taxonomy, it is possible to discern Lower-Order Thinking Skills (LOTS) associated to teaching and learning strategies, such as mnemonic strategies, workshops of reiterative exercises or procedures repetition, etc. As well as

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the strategies associated to HOTS such as structuring information, inquiry projects, creative projects, metacognitive, communication and collaboration strategies.

To enliven these HOTS-related strategies, it is expected the training in pedagogical uses of ICT to influence on allocating the students more participative and proactive roles, within the class. When referring to participative or proactive roles, we talk about tasks like contextualizing learning contents, searching, selecting and structuring information, creative activities, problem solving, as well as self and peer assessment of learning. These roles contrast with passive or receptive roles, distinctive of traditional education, where the typical activities done by the student are restricted to reproducing the information provided by the teacher, applying knowledge through examples or explanation of situations and practicing skills or recognizing knowledge in hetero assessment activities.

Furthermore, by planning their teaching-learning strategies, involving digital educational resources, it is expected the teachers to allocate themselves mediating and not commanding roles. Mediation roles refer to actions such as interacting with students through questions, giving the students feedback of their performance in the tasks, being mediator in conflicts and decisions making within a group, leading positively a dynamic and integrative environment in class and helping the students be acquainted with significant resources for their activities. These roles contrast with the ones that possess a more managing nature, such as expositive presentations of topics, leadership based on penalties and learning assessment based on the information provided by the teacher.

3. Method

3.1 Participants

This research analyzed a sample of 547 UP designed by teachers. However, 9 UP were excluded from the analysis, since they exhibited lost data in the study variables; thus, the final sample was 538 UP. The sample was stratified according to rural (34.8%) and urban (65 %) educational institutions; and subjects of: mathematics (21.4%), language (25.1 %), science (21.0 %), technology and others (32.5 %).

3.2 Instrument

A checklist was used to collect information, in which 3 aspects of each UP selected were identified and classified: the type of teaching-learning strategy used, classified into two categories, beneficial to HOTS and beneficial to LOTS; likewise, the roles allocated to students, classified into passive-receptive roles and active-participative roles; finally, the roles self-allocated by the teacher, classified into commanding or mediating roles.

3.3 Procedure and design

A clustering strategy was employed in order to get different classes to gather the UP according to the characteristic teaching-learning strategy and the roles played by teachers and students. In terms of statistical analysis, a multiple correspondence analysis was conducted for the three variables defined. Then, from a hierarchical classification based on a mixed algorithm, that includes Ward's method and K-means clustering, four classes with the lowest intra-class inertia were identified. During the consolidation process were selected four axes that preserve the 54.9% of inertia and four classes, shown in factorial plane (Figure 1), that enable observe trends and clusters positions. Once the data was obtained, the relevant statistical analyses were carried out with R-project. The factorial plane shows the four clusters obtained from the data, along with the organization of teaching-learning strategies and the roles played by teachers and students. The rural and urban categories are used as an illustrative variable.

4. Results

The Table 1 presents the categories and variables, ordered within each class by the test values, and it shows only those that pass the threshold $v.lim$, the p -value and the cluster characterization by active variables frequency.

Thereby, the first class has 214 UP (39.7%) with $p=0.000$ and corresponds to a Passive or receptive role played by the students (68,2%), LOTS (76.6%) and Actions for manage or command (77 %). In general, the interaction between students and teachers is limited to the relation presented in the unit plan, but



doesn't encourage the students to cooperate/collaborate and to develop their knowledge and concepts. This proves teachers focus on using ICT in traditional strategies. The second class has 151 UP (28%), $p=0.000$ with HLOTS (64.2%), Actions for manage and mediation by teachers (49,7 %) and a Passive or receptive role by students (96%). In this case, the UP have a higher tendency for information structuring, skills practice / students usage of procedures, with the purpose of making the student succeed organizing the information presented by rehearsing concepts. This proposal aimed to the application of contents, that most of the time present the student a context and a problem that must be solved. Presentation programs, word processors and online tests are generally used. The third class has 99 UP (18.4%), $p=0.000$ and combines a Proactive and passive role by the student (91.9%), HOTS (58.6%) and Actions for mediation by the teacher (14.1 %). There's a mayor participation in web discussions, communication, collaboration and a feedback of the discussions through multimedia material designed by teachers, with a higher participation of students, use of blogs, specialized software, virtual forums, e-mail, social networks and cellphones, where the students can find a place to share their contents and productions. Finally, the fourth class (13.7%) presents, meaningfully, UP from the rural area ($p < 0.05$) with a Proactive and participative role by the student (14.3 %), HOTS (74.3 %) and Actions for manage or command (85,1 %). It is characterized for presenting structuring strategies, such as designing mind maps through presentation programs, in which, through socialization, are presented the information structuring and guidance for the contents instruction. Also, metacognitive strategies are implemented, and by a collaborative research, the students plan, explain and predict consequences through a work that involves using ICT as a group and in an organized way.

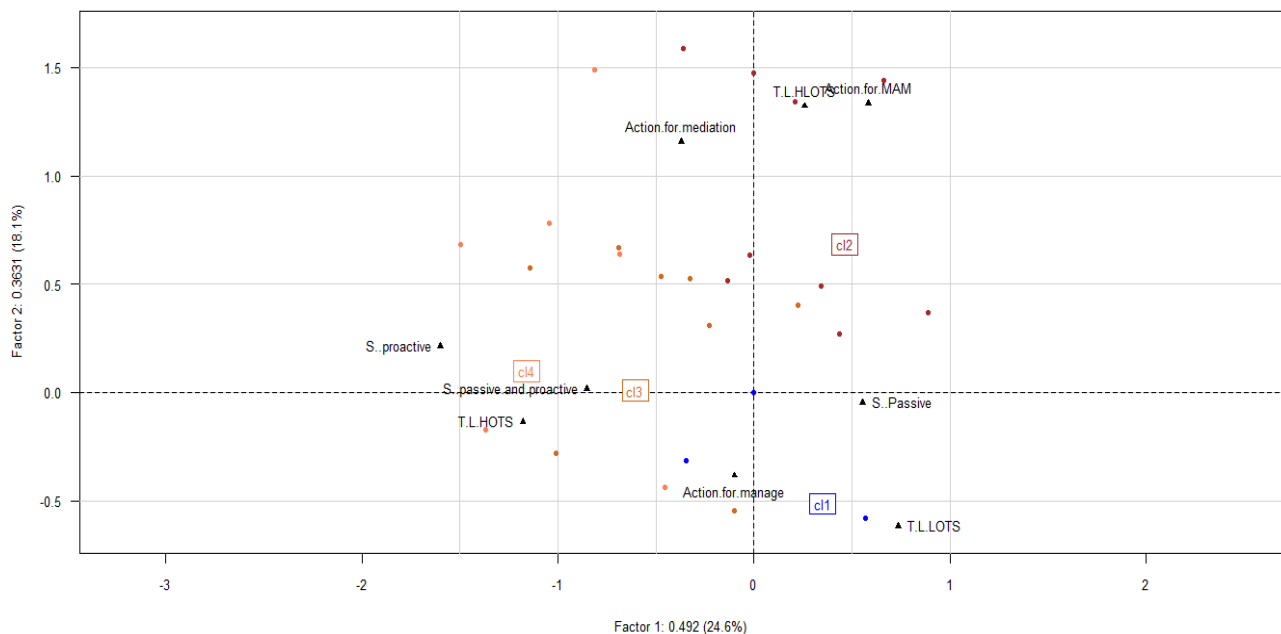


Figure 1. Factorial plane: Strategies for teaching and learning (T-L) with roles played by teachers and students



Table 1. Description of the number of classes found and the roles played by the students according to T-L strategies

	Test.Value	p.Value	Class.Cat	Cat. Class	Global
Class: 1					
Passive or receptive role	14.778	0.00	58.3	100	68.2
Lower order thinking skills	12.755	0.00	69.8	76.6	43.7
Actions for manage or command	12.003	0.00	51.7	100	77
Class: 2					
Higher and lower order thinking skills	13.264	0.00	75.8	64.2	23.8
Action for manage and mediation	12.035	0.00	82.4	49.7	16.9
Passive or receptive role	9.618	0.00	39.5	96	68.2
Class: 3					
Proactive and passive role	20.03	0.00	96.8	91.9	17.5
Higher order thinking skills	5.954	0.00	33.1	58.6	32.5
Actions for mediation	3.348	0.01	42.4	14.1	6.1
Class: 4					
Proactive or participative role	19.902	0.00	96.1	100	14.3
Higher order thinking skills	7.956	0.00	31.4	74.3	32.5
Rural area	2.067	0.04	17.6	44.6	34.8
Actions for manage or command	2.002	0.05	15.2	85.1	77

5. Discussion

The results shown in these four clusters are characteristic of the UP planned by the CreaTIC teachers, what confirms the initial conclusions that emphasize on the small impact when including ICT in innovation processes within teaching practices [2]. Similarly to those studies, the UP clustered in Class 1 (39%) show how teachers include ICT to support traditional tasks and roles within their practices. A factor that might be associated to this result relates to the emphasis of the CreaTIC program, particularly in the on-site phase, which granted relevance to the training on software management to control video, audio and illustration. Likewise, it can be related to the instructional design methodology provided in the program: ADDIE. In general, it can be confirmed that the teachers experienced a process oriented to the development of the resource more than to its use; thus, they obviously associated their traditional needs.

On the other hand, it is noteworthy that 61% of the UP evaluated presented some changes regarding the type of strategies and the roles played by teachers and students. At first, the UP clustered into Class 2 showed the impact of the actions planned by the teacher when including alternately strategies that bind together a more extensive and varied range of mental processes. This relates to the fact that when including HOTS, it is necessary to increase the interaction with the student in order to validate and feedback their performance for the tasks assigned.

However, as shown in the UP clustered into Class 3, only when a leading role is allocated to the student, a work, purposely directed towards their HOTS, is produced; and ends relating to a role played by the teacher, focused toward mediating learning rather than validating the understanding of the information provided by themselves. As shown in the resources used by these UP, these processes are more propitious when the teacher use educational resources designed to ease the communication and



collaboration between students rather than when using digital resources to introduce concepts or to measure the individual performance.

The incidence of this kind of resources and interactions between students is highly related to the teachers' incidence of new pedagogical visions and necessities. This suggests that learning how to use ICT strengthen the traditional dynamics performed by teachers and their avoidance to use this kind of resources [3].

6. Conclusions and recommendations

The conclusions of this study reinforce the need to strengthen the pedagogical component of the teachers training programs on the use of ICT. This need is related to the result that suggests, in accordance to previous investigations, that teachers use ICT resources to meet pedagogical needs they're familiarized with. Thus, it is necessary to encourage changing, on purpose, the methodological perspective within their practices rather than waiting for this effect to occur itself when using ICT.

Regarding these results, it can be addressed that teachers start changing methodology by blending traditional strategies with new ones, and in this sense, alternating new roles with common roles. This latter because their methodologies alternate strategies that foster HOTS and LOTS in the students. Also, the results suggest the teachers that change significantly their own role and the role played by the students, favoring HOTS, are teachers that include digital educational resources to foster communication and collaboration between the students, even without considering resources to present information or practice skills; therefore, teaching training programs should emphasize on these resources, characteristic of the ICT 2.0.

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